DOCUMENT RESUME

ED 315 962 EC 222 713

AUTHOR Hollaway, Becky L.
TITLE Improving Elementary LD Students' Recall of Social Studies and Science Vocabulary Using Mnemonic Instruction.
PUB DATE 89
NOTE 77p.; Ed.D. Practicum Report, Nova University.
PUB TYPE Reports - Research/Technical (143) -- Dissertations/Theses - Practicum Papers (043) -- Tests/Evaluation Instruments (160)

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS Elementary Education; *Learning Disabilities; Learning Strategies; *Memory; Metacognition; *Mnemonics; Questionnaires; *Reading Instruction; Reading Strategies; *Science Instruction; Study Skills; *Vocabulary Development
IDENTIFIERS *Keywords; Prereferral Intervention

ABSTRACT

This study conducted in a midwestern city, addressed problems experienced by learning disabled (LD) students in recalling specialized science and social studies vocabulary. This apparent problem was confirmed by a teacher questionnaire and analyses of types and frequency of test errors on recent exams. Students appeared unfamiliar with memory strategies as a means to enhance vocabulary recall. Previous production deficiency studies had suggested the teaching of mnemonic strategies and imposition of other organizational strategies as successful solutions to vocabulary recall problems in LD children. Lists of selected key terms from each content area and grade level were created, and on single sheets of paper a keyword was illustrated interacting with the meaning or attribute of the term. These sheets were used in training sessions, and students' understanding of the terms tested. Results indicated the program was effective, with LD students in the 85-116 IQ range showing both clearest ability to use the keyword system and commensurate benefits. Interviews with students showed heightened awareness of the relationship of mnemonic aids to improved recall. The teacher questionnaire and student strategy interview format are appended. Contains 46 references. (PB)

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ED315962

Improving Elementary LD Students' Recall of Social Studies and Science Vocabulary Using Mnemonic Instruction

by

Becky L. Hollaway

Cluster XXVIII

A Practicum I Report presented to the
Ed.D. Program in Early and Middle Childhood
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Education

NOVA UNIVERSITY

1989

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ABSTRACT

Improving Elementary LD Students' Recall of Social Studies and Scienc Vocabulary Using Mnemonic Instruction. Hollaway, Becky L., 1989: Practicum Report, Nova University, Ed. D. Program in Early and Middle Childhood. Descriptors: Learning Disabilities/Mnemonics/Vocabulary Development/Learning Strategies/ Recall/Memory/Elementary Education/Reading Instruction/Exceptional Child Research/Social Studies Instruction/Science Instruction

This practicum addressed the problem that LD students had difficulty recalling vocabulary in the areas of science and social studies. The goal was for students to recall content related vocabulary through the application of the keyword mnemonic strategy. It was expected that the LD students would perform at a 70% accuracy level on five or six objective tests.

To assess the LD students' practicum goal attainment, the writer administered a series of objective tests in social studies and science and a student strategy interview. To assess the regular teachers' perceptions of the students' vocabulary recall, a teacher questionnaire was administered. In implementating the practicum, the writer provided vocabulary instruction using the keyword mnemonic method and developed the mnemonic materials.

The student performance results were positive with all of the LD students completing the program performing above the established criteria. The results of the student strategy interview were positive also, indicating that most of the LD students used the mnemonic strategy to aid in the recall of science and social studies vocabulary. The results of the regular teacher questionnaire did not parallel the positive student performance results. An unexpected and alarming number of students were identified by the regular teachers as having vocabulary recall difficulties after the implementation of the practicum.

CHAPTER 1

INTRODUCTION

Description of Work Setting and Community

This study was conducted in a midwestern city situated on the perimeter of a large metropolitan area. The city had historically depended on an industry which was declining; thus, the city had a high level of unemployment and indigency.

The communities in which this study occurred reflected the economic depression characteristic of the city. Unemployment was high and many houses and small businesses were abandoned. The population of the community was racially mixed comprised of predominantly Black and Hispanic families. The families were often transient moving within the community and between communities within the city.

The immediate setting consisted of three elementary public schools which serviced students in kindergarten through grade six and one visual and performing arts school which serviced students in grade six through twelve. Two of the elementary schools were small having approximately 300 students each and offered regular and learning disabilities (LD) itinerant special education programs. The other elementary site was large with approximately 800 students receiving regular or special education programs. The special education programs included classes for the mentally retarded and LD children. Also, a variety of social services existed at all of the elementary sites, such

as At-Risk counseling and social services.

At the visual and performing arts school, approximately 300 students identified as gifted in the areas of art, music, or drama attended regular classes and classes in the performing arts. Special education services were offered on an itinerant basis for LD students.

The characters involved in the study were 25 resource and itinerant LD students exhibiting specific deficits in perceptual, integrative and/or expressive processes which impair their learning efficiency. The students enrolled in the LD program experienced chronic failure in the regular setting and were deficient in educational skills resulting in achievement at one to two years below grade expectancy. Academic potential, as determined by the WISC-R, was normal or above normal as indicated by a full scale IQ score of eighty-five or above. Characteristic of these students then was the severe discrepancy between normal potential and academic achievement.

Typically, the academic areas directly affected by the student's learning disorder included one or more of the following: basic reading skill; reading comprehension; written expression; expressive language; mathematics calculations and reasoning; and listening comprehension. The severity of the learning disorder concurrent with the expected grade performance determined the nature of the special education services offered which included placement considerations and type and area of instruction needed.

The LD students in this study received either instructional LD resource service in which they remained in their regular placement for the major

portion of the day and were scheduled into the instructional resource service for tutorial or small group instruction or itinerant services. A primary condition of the resource service indicates that there is a special disability as evidenced by the results of correlates of information obtained from an educational evaluation and classroom observation. The LD student's academic performance is not too far below the level of performance in the educational setting in which he belongs because he has developed some techniques for compensation. However, the disability is still visible and the regular teacher is not able to provide remediation. Similarly, the primary condition of the itinerant services is that the discrepancy between actual and expected performance is remediable through minimal direct special education intervention.

The other characters involved in this study are 20 regular educators. This included mostly primary and intermediate level teachers with one teaching sixth and seventh grade at the visual and performing arts school. While most of teachers had self contained structures, the itinerant site teachers had departmentalized structures.

Writer's Work Setting and Role

The writer's work setting consisted of LD resource classes and three itinerant classes. The resource classes, situated at a single site, provided remedial or supplemental instruction while the students were enrolled in regular classes. Classes were scheduled from 30 to 90 minutes daily as determined by student need. Usually the writer worked with an individual student or with a

small group. Group sizes ranged from four to eight students.

The itinerant classes were located in the students' neighborhood schools except in the case of the visual and performing arts student who attended the special school which provides specific performing arts instruction for talented students. The writer traveled to the schools to provide direct instruction to the students on a one time per week basis. Instructional time ranged from 60 to 90 minutes. The writer worked with individual students although as many as five students attended the itinerant classroom at one time.

The writer was responsible for the direct instructional program for LD students and for assisting the LD students' regular teachers. The instructional program included specific teaching responsibilities such as assessing student needs, prescribing learning activities, directing activities, monitoring student progress and evaluating performance. Specific to LD this involved the teaching of compensatory perceptual skills, identifying learning styles and instructing in the use and application of learning strategies.

Consultation with the regular teachers was related to the development and implementation of the LD student's regular and special education program. Specific assistance was given with curriculum development, teaching techniques, material utilization and program adaptations specific to the LD student's learning style and disability.

CHAPTER II

STUDY OF THE PROBLEM

Problem Description

The problem was that LD students performed poorly on written items requiring the student to supply or recognize key social studies or science vocabulary. The characteristics of this problem could be described as curricular composition, instructional methodology, and student related difficulties.

Typical social studies and science texts are heavily laden with technical and unfamiliar vocabulary. Meyer, Greer, and Crummey (1986) while analyzing science texts, noted that the vocabulary was problematical because it was beyond the experiential level of the child. Technical terms are often used without consideration of background knowledge. They also found that in some instances a startling amount of vocabulary was introduced within a content domain. For example, in some texts the number of vocabulary introduced ranged from 210 to 466 words in 15 content domains.

In the writer's setting, the amount and nature of the content vocabulary was similarly technical and unfamiliar. For example, texts in grades four, five and six averaged three to five key vocabulary terms per page. Many of these terms could be classified as unfamiliar at both the listening and reading levels of the student. Also, the written texts relied heavily on the recall of vocabulary and vocabulary usage. Students were usually required to supply words or phrases in a short answer format and to apply word meanings in a

multiple choice format.

Instructional methodology in social studies and science is not characteristically reading skill related (Armbruster & Gudbrandsen, 1986). Although proficiency in the content areas depends on the integrity of the student's reading ability, reading related skills are not often taught as correlates of those areas. Armbruster and Gudbrandsen reported that often direct instruction in social studies relies on the teacher directing the students to apply reading and study skills without instructing them how to accomplish that task. Practice and application directions are replete with terse directives to encourage the students to 'recall information' or 'read to obtain specific information' without any suggestions of methodology.

Similarly, the suggestions of instructional methodology in the writer's setting was discussion related and did not offer techniques for skill acquisition or application. This was especially noticeable in the social studies teacher's guide and student text in which key vocabulary and questions (to think about) were listed without any instructions of use or application.

The final consideration in the problem was the child himself. LD children have many reading related difficulties which can impact on their performance and achievement in content related areas. Since reading is not a matter of single discrete processes, a variety of cognitive correlates are necessary for proficient reading including such dimensions as perception and memory. If one of these correlates in developmentally delayed or

neurologically impaired, reading skills and their application in content areas can evidence problems. In the writer's setting, the LD children had memory difficulties related to language and language processing. Memory deficits for these children were a pervasive problem affecting reading skills in general and reading related skills such as vocabulary recall.

It would appear that several problems existed whereas in actuality only one was a soluble problem. First, each subject area had a vocabulary of its own that must be learned regardless of its unfamiliarity or number. Also, the regular and special educators in this setting were unable to select their own curricular materials; thus, curricular composition was not a problem that could have been solved. Second, the problem of inadequate instructional methodology could be approached as a solution. The problem then, was that LD students had memory difficulties related to vocabulary recall which affected their performance on social studies and science tests.

Problem Documentation

To prove that the recall of vocabulary was a problem for LD students, two methods were used. First, a questionnaire was administered to all of the regular teachers (see Appendix A). The results of the questionnaire (see Table1) indicated that 92% of the LD students had difficulty recalling key vocabulary in the areas of social studies and science. As to responses to test items, teachers indicated that 96% of the LD students had difficulty supplying vocabulary to short answer items while 72% had difficulty recognizing vocabulary in multiple choice items.

Table 1

Results of Teacher Responses to Social Studies/Science Questionnaire

	Student has difficulty	Student does not have difficulty
General concept comprehension	16%	84%
Specific concept comprehension	24%	76%
Recall of basic facts	44%	56%
Recall of key vocabulary	92%	8%
Supplying vocabulary to short answer items	96%	4%
Recognizing vocabulary in multiple choice items	72%	28%
Number of teachers responding	20 of 20	
Number of students concerned	25	

The writer also examined the types and frequency of test errors using a recent exam from both subject areas. The criterion for assessing an item as vocabulary dependent was that the statement and/or questions contained key vocabulary; key vocabulary was defined as those words specific to the content area. The error analysis (see Table 2) revealed that from 82 to 100% of the science test items were vocabulary dependent while from 50 to 90% of the social studies items were vocabulary controlled. Also indicated, was the slight variance in vocabulary dependent items between grades while only slight differences between the content areas was evident. The mean percentage of correct responses in science ranged from 32 to 64% and ranged from 22 to 48% in social studies. Disaggregated data were also recorded for pretest/post test comparisons (see Table 3). This data revealed that of the 50 tests administered, only five had scores of 70% or better. Also evident was that only one student performed satisfactorily on both tests (student 9).

Causative Analysis

Many LD students have vocabulary problems in the areas of social studies and science and some of their difficulties can be attributed to deficient memory performance, inadequate metamemorial knowledge, and poor strategy application. All but three of the students in this investigation had been identified as visual and/or auditory memory deficient by a psychologist and educational specialist. Although the severity of memory deficits varied, 22 of the 25 LD children were considered to have many problems related to the recall of visually or auditorally presented language.

Table 2

Analysis of Vocabulary Dependent Test Items and Average Performance

	Percentage of Items Vocabulary Dependent	Mean Percentage of Correct Responses on Vocabulary Items
Grade 2		
Science	100%	40%
Social Studies	50%	22%
Grade 3		
Science	89%	32%
Social Studies	75%	48%
Grade 4		
Science	82%	64%
Social Studies	90%	41%
Grade 5		
Science	92%	38%
Social Studies	87%	45%
Grade 6		
Science	100%	37%
Social Studies	82%	45%

Table 3

Student Pretest Performances

Students	% Correct Science	% Correct Social Studies
1	60%	30%
2	40%	20%
3	50%	30%
4	20%	30%
5	30%	0%
6	15%	44%
7	48%	59%
8	33%	11%
9	71%	70%
10	53%	40%
11	94%	40%
12	65%	50%
13	47%	30%
14	82%	50%
15	41%	10%
16	41%	31%
17	49%	54%
18	24%	38%
19	36%	57%
20	35%	59%
21	41%	29%
22	64%	64%
23	23%	21%
24	73%	43%
25	55%	29%

The lack of metamemorial knowledge coupled with the lack of spontaneous strategy application can also cause poor memory performance. When the LD students were questioned as to what they did to remember vocabulary, their responses were generally inappropriate which included replies like 'I don't know' and 'I just skip it.' Those that reported that they were instructed to write the term with its meaning could not identify how this helped them study or recall the word. Generally, the LD students appeared unfamiliar with the utility or need for memory strategies as a means to enhance the recall of vocabulary.

Relationship of the Problem to the Literature

Reading is a dynamic process which involves cognitive structures such as perception and memory. Since one of the main purposes of reading in the recall of information, the memory processes involved in reading represent an integral part of that complex process. Research suggests that the differences in memory development and performance may account for the differences in reading ability and recall of information often evidenced by learning disabled (LD) children (Torgesen, 1978-1979).

The structure of memory is multidimensional and develops along a broad continuum of memory competence (Ornstein & Naus, 1984). The memory components related to reading include sensory register, iconic image, short term memory and long term memory (Spear & Sternberg, 1987; Morrison, 1987). Sensory register refers to the temporary storage of stimuli from the five senses; iconic image is the matching of visual input to a stored visual image (Torgesen, 1978-1979); short term memory is the 'working memory'

where information is stored for brief periods of time; and long term memory is where information is permanently stored. Long term memory consists of three subprocesses: 1) episodic memory involves the storage of time and place information; 2) semantic memory involves the storage of general concepts, ideas and language; 3) imagery memory retains images both concrete and referential (Corsale & Ornstein, 1980). Thus, memory and its relationship to reading is multidimensional and multivariant.

How the memory dimensions and variables relate to the cause of reading differences in LD children can be explained in the context of Atkinson and Shiffrin's (1968) model of cognitive processing. Atkinson and Shiffrin postulated that cognitive processing is composed of dichotomous features: structural processes and control processes. Structural processes are invariant and unmodifiable while control processes are production oriented thus changeable or trainable. Thus, when processing deficiencies are identified as responsible for the LD child's poorer memory performance, it is attributed to structural limitations such as encoding rate; whereas, when production deficiencies are identified, control limitations are implicated such as the failure to spontaneously deploy mnemonic strategies.

Research on memory as a structural process considers three basic capacities: available storage, rate of encoding and speed of retrieval. Generally, investigators have reported that LD children as compared to non LD students differ by exhibiting a slower retrieval rate, slower and weaker encoding rate and in the capacity of storage space.

Chabot, Petros and McCord (1983), in experiments to access the relationship between speed of phonological and semantic memory and reading ability, designed categorical judgment tasks in which the word and picture response time of skilled and unskilled readers was compared. They determined that unskilled readers were deficient in the speed of encoding, the speed of lexical access, and the speed of semantic memory access. It was concluded that the speed at which unskilled readers access semantic memory results in their poorer word recognition.

In a similar study, Lorsbach and Gray (1986) postulated a causal relationship between the LD child's slower item identification and memory span performance. In their experiment, item familiarity was manipulated to determine if the LD child's performance in comparison to the non LD child could be attributed to speed of encoding. Presenting a variety of stimuli such as digits, letters, colors, and shapes, subjects were instructed to recall the sequence of increasing larger groups of stimuli at time intervals. Lorsbach and Gray found that LD children exhibited significantly lower memory span scores and significantly slower item identification rate which was attributed to slower retrieval of semantic memory.

Slower identification rate as it relates to retrieval has also been investigated by Manis (1985) and Howell and Manis (1986). In a study with normal and disabled readers, Manis tested the recall of the meaning and pronunciation of extremely low-frequency words. He hypothesized that since the difficulty of decoding the words would be similar for both groups of subjects,

then a difference in naming performance after a practice session would indicate a naming latency related to response processes (retrieval). As postulated, the results indicated that disabled readers were slower in identifying words and concurrently were less efficient in coding and retrieval as demonstrated by decreased performance on words of longer length and more complex phonetic structure.

Examining the types of stimuli affected by slower encoding rates, Howell and Manis (1986) conducted an experiment in which normal and disabled readers verified the names of familiar picture and word stimuli when verbal cues were presented. The investigators found that disabled readers were both slower at verifying picture or word names and slower in making categorical decisions than normal readers. These findings were interpreted as evidence of deficits in internal lexical retrieval and higher order semantic processing related to printed words and picture stimuli.

Several studies concerning the nature and rate of encoding concur that LD children evidence slower and weaker encoding ability. Swanson (1982) investigated the semantic encoding differences between LD, non LD and deaf children. Swanson reported that LD children experience a verbal-visual processing deficit occurring prior to the application of mnemonic strategies which contributes to visual recall difficulties. He maintains that this processing deficit interferes with verbal rehearsal as a mediating link for semantic recall. Swanson (1983) replicated this study which produced similar results suggesting that weak or shallow semantic encoding interferes with the LD child's recall of

words.

In another study, Manis and Morrison (1982) hypothesized that word encoding, or the visual attention to critical word features and the subsequent internal representation, was slower and less accurate in reading disabled children. Conducting an experiment with normal and disabled readers, Manis and Morrison tested the amount and identity of visual features recalled when an array of familiar stimuli are briefly displayed. They observed that non-disabled readers identified a significant amount of salient visual features as opposed to the disabled readers. Also, the disabled readers were less accurate in judging the position of stimuli. Because the need to retrieve item information was controlled by the presentation of the original recall format, the authors suggested that the quality and rate of encoding was responsible for performance differences.

The final structural attribute examined is that of storage capacity. In an experiment with dyslexic and normal children, Nelson and Warrington (1980) observed that dyslexic children's short term memory was impaired in respect to storage capacity. Conducting a series of tests to measure short and long term memory storage and semantic memory functions, they purport that dyslexic children performed significantly poorer on digit span tasks in which the subject repeated sets of increasing length digits forwards and backwards. This finding was interpreted as impaired storage capacity. Further, they suggest that encoding new information into semantic memory is affected by the capacity and encoding rate which could account for the reading differences between dyslexic and normal readers.

Swanson (1986) similarly explored the hypothesis that a storage deficiency rather than a retrieval deficiency was responsible for differences in recall. Swanson, working with LD and skilled readers, presented picture stimuli with or without names. The children were subject to one of three training conditions: to associate shapess to names representative of the shapes (name associated condition); to associate arbitrary names to shapes (nonassociated name condition): to associate a visual representation with a representative distinctive feature of the shape (unnamed condition). Swanson reasoned that differences in responses using a probe-type serial recall task would indicate the role that verbal processing has on visual recall and the locus of verbal coding difficulties. The results of this experiment were that the LD subjects performed significantly better on recency position items as compared to non LD subjects who performed significantly better on primacy and middle positions in the three training conditions. Swanson interprets these findings as indicative of the LD child's deficient transfer of information from short term to long term memory as supported by their poor performance in the recall of primacy and middle positions. He suggests that depositing a memory trace in long term storage is related to storage rather than retrieval capacity.

From the research examined thusfar, it is apparent that the memory performance of LD children is affected by various structural constraints. Furthermore, it is evident that a variety of memory constructs are responsible for adequate recall. As some researchers have suggested, (Bauer, 1979 ; Nelson & Warrington, 1980) a combination of memory processes is associated

with the differences evident in the recall ability which characteristically is deficient in LD children. Hence, the second line of evidence is in the area of control processes.

Many researchers have characterized LD students as inactive learners (Graham & Freeman, 1986; Torgesen & Kail, 1980; Wong, 1980). This description originated (Torgesen, 1977) when studies revealed that LD children were less likely to actively use word or item rehearsal strategies than their peers. The LD child's production deficit, namely a controll process deficiency, has been consistently shown in the research as the limiting factor that affects memory task performance.

Investigating the production deficit hypothesis, Torgesen has conducted numerous studies exploring the relationship between short term memory and deployment of efficient mnemonic strategies. Torgesen (1979) reasoned that the LD child's failure to engage in goal directed activity and the subsequent inefficient and unorganized management of cognitive information were critical factors in poor performance on rote recall tasks. Torgesen, Murphy, and Ivey (1979) conducted an investigation in which this premise was tested. They hypothesized that if LD children were taught to process material effectively, then their performance on recall tasks would be similar to non LD children. Both LD and non LD children were given two free recall tasks in which they were required to recall the position of pictures to an array without, then with, the aid of mnemonic strategy instruction. Generally, the LD subjects failed to employ efficient strategies in the control condition (without mnemonic training)

performing significantly poorer than the non LD subjects which supports the premise that a processing deficiency interferes with adequate recall. Additionally, an increase in memory performance was noted with both groups of subjects when mnemonic training was given with LD subjects performing equivocally to non LD.

The lack of efficient strategy utilization has also been cited by Lines and Keenan (1981). Using pictures and letters presented orally and visually, LD and non LD children performed a free recall task and serial recall task in which the number and order of items recalled were measured without imposed strategy training. Performance for the LD children was significantly poorer on both recall tasks in general; yet, recency performance was significantly different from that of the non LD subjects which Lines and Keenan interpret as evidence of verbal rehearsal. Findings suggested that older LD children (aged nine and above) used similar verbal rehearsal strategies as the non LD children but in a less effective or flexible manner.

In a similar investigation, Bauer (1979) found that LD and non LD children performed comparably on tasks of recency with stimuli presented visually or verbally. In a series of experiments Bauer examined LD and non LD responses to categorical and noncategorical recall tasks. LD children's performance results included a lower primacy effect, slower encoding of items beyond the primacy level, lower strategic clustering, and the requisite of more trials to recall items. Bauer concludes that a deficit in the use of efficient elaborative encoding strategies attributes to the poor short memory retention

and the lower acquisition rate.

Graham and Freeman (1986) also report evidence that LD children fail to spontaneously enact in effective strategic behavior. In their study examining the variations in study procedures in the area of spelling, they found that LD children engage in on-task behavior similar to non LD children; yet their study procedures are often ineffective. Graham and Freeman classify this behavior as a deficit in self regulation.

As a whole, these production deficiency studies have suggested that differences in the recall ability of LD and non LD children dissipates when LD children are taught mnemonic strategies or when organizational strategies are imposed. The mere fact that production deficiencies are inferred as responsible for the performance differences implies a causality and remediation which may be overgeneralized and which may overlook structural deficiencies which are existent. Shepherd, Gelzheiser, and Solar (1985) conducted two experiments in which the oversimplification of the strategy deficit theory is investigated. Using the picture study/recall task used by Torgesen (1977), the researchers found that LD versus non LD performance did not vary significantly, with both groups failing to categorize effectively. Differences were evident in the use of clustering at the recall level and in the total number of items recalled. Shepherd et al. suggested that in spite of these differences, the experimental design offered a classification formula that was greatly influenced by chance. They caution further that the recall task measured by this experiment does not have an apparent cognitive correlate or classroom application. The next

research reviewed considers an explained view of the production deficiency theory offering both a structural and production causality.

Torgesen and Houck (1980) conducted a series of experiments to determine both the production and processing deficits underlying the learning disabled (LD) child's poor performance on memory tasks. The subjects included LD children with average short-term memory (LD-N), LD children with short term memory deficits (LD-S) and non LD. Generally, the results indicated that LD-S subjects' memory performance did not improve when given incentives; LD-S subjects processed familiar stimuli at a slower rate; LD-S and LD-N subjects failed to spontaneously employ mnemonic strategies; and all subjects showed recall improvement on tasks with an experimenter imposed strategy (chunking). Torgesen and Houck interpret the findings as evidence that both structural and control limitations impact the memory performance of LD children. Additionally, they purport the need for evaluative instruments which directly assess and diagnose the memory ability or disability as it relates to academic achievement.

Another aspect of memory performance related to strategic behavior is that of metamemorial behavior. Although some researchers have postulated that there is a relationship between LD children's memory deficit and a metamemorial deficit (Borkowski & Kurtz, 1984; Torgesen & Kail, 1980), their studies were limited to LD subjects with memory deficits rather than inclusive of the LD population. One study, conducted by Goldstein and Golding, (1984) compare the metamemorial knowledge of normal children, LD children with short term memory

deficits and LD children without memory deficits. They found that a metamemorial deficit does not apply to LD children as a homogeneous group rather only the subgroup classified as memory deficient experienced metamemorial deficit. Similarly, Lines and Keenan (1981) found that LD and non LD children showed equivocal knowledge of metamemory; whereas, LD children may evidence a developmental lag related to actual strategic performance.

The educational implications of this research review are twofold: instructional decisions should reflect the nature and extent of interferring structural and control processing deficits and instructional decisions should reflect the awareness that the memorial process is neither a single nor a constant construct; rather, it is a complex set of changing and changeable processes. These tenets, concurrent with the awareness that memory as it relates to the reading process is a multidimensional, multirelated phenomena, propose a challenge for regular and special educators.

CHAPTER III

ANTICIPATED OUTCOMES AND EVALUATION INSTRUMENTS

Goals and Expectations

The goal of this program was that LD students would recall content related vocabulary. It was expected that they would apply mnemonic strategies to aid in that recall.

Behavioral Objective

It was expected that given a test in social studies or science in a regular classroom setting, the LD students would recall key vocabulary by recognizing the vocabulary in context (multiple choice format) or in isolation (short answer or matching formats) performing at the 70% level of accuracy on five of six trials.

Measurement of Objectives

A series of objective tests were administered to measure the obtainment of the practicum goal. The number and format of test items were similar in both subject areas. Test items at the second grade level consisted of approximately ten items: five statements in which a picture related to the statement were identfied and five statements in which the student was required to select from three words the correct word to complete the statement. Test items at the other grade levels consisted of between 20 to 25 items: five to seven statement completion items in which the student supplied a word to

complete a statement given a group of words and 15 to 20 multiple choice items. The tests were untimed with assistance given with directions.

The rationale for using the textbook made tests was: 1) the regular teachers used these tests as a basis for evaluation; 2) classroom instruction and activities emphasized the same concepts as presented on the tests; and 3) the number of items that were vocabulary dependent were sufficient to adequately evaluate an intervention treatment program. Use of the textbook made tests allowed the regular and special educators to evaluate performance and analyze errors in a consistent and systematic manner.

Mechanism for Recording Unexpected Events

To record both expected and unexpected events, a journal was kept. The journal afforded a means to record procedural and materials strengths and weaknesses which could not be readily gleaned from individual or group test data. For example, when the mnemonic lessons were presented, error patterns were recorded to determine if the keyword mnemonic link or the interactive illustration mnemonic link was inadequate. Thus, if a student or a group of students failed to recall the keyword on two successive presentations, it was concluded that the keyword selected had either a weak acoustic link or was unfamiliar to the students. Consequently, the keyword was changed and the vocabulary concept was retaught in the next lesson. The same procedure was used if successive errors recalling the illustration occurred.

CHAPTER IV

SOLUTION STRATEGY

Discussion and Evaluations of Solutions

The implications of the research describing the nature and extent of interferring memory factors experienced within the LD population are directly associated with vocabulary instructional decisions. From the proliferation of research supporting the direct instruction of mnemonic devices, it would appear that this technique is a viable strategy to increase the vocabulary recall in LD children.

Bellezza (1981) describes mnemonic devices as facilitators of the storage and retrieval of information. The mnemonic devices are artifices which create a cognitive mediator, or cuing structure, between the learner and the information to be remembered. The cuing structures, typically picture images or words, act as a signal or stimulus for the learner to recall. Thus, mnemonic devices provide the learner with a mediational link between the information to be recalled and various cognitive structures.

Other methods of remembering include verbal rehearsal and assimilation. The verbal rehearsal technique has been considered easily adapted to all content areas (Scruggs, 1985) and has been found an effective mnemonic strategy in increasing recall in LD children. Rose, Cundick, and Higbee (1983) in an experiment with elementary LD children found comparable differences in recall performance when treatment consisted of verbal rehearsal, visual imagery or

unaided instruction. Results indicated that reading comprehension and retention increased significantly in both verbal and visual instruction groups with verbal rehearsal showing the greatest improvement.

Assimilation is the presentation of information whose conceptual structure relates to a memory schema (Bellezza, 1981). Techniques include semantic elaboration (Sugden & Newall, 1987), picto-organizer (Alvermann, 1985), pictorial mnemonics (Ehri, Deffner, & Wilce, 1984), and multisensory study techniques (Derr & Peters, 1986). Ehri et al. in experiments with prereaders found that children associated the sound with its symbol (letter) more frequently when instructed with integrated mnemonics as compared to instruction with dissociated pictures or no pictures. From the superior results experienced in the integrated mnemonics condition, the authors concluded that the conceptual association of the symbol to the sound was mediated by a visual, pictorial memory schema.

These methods of remembering have met with criticism. First, Scruggs (1985) and Ehri et al. observed that verbal rehearsal was the least effective mnemonic method. Also, assimilation methods are dependent upon existing experiential schemata. If the experience with the word or concept is nonexistant, then the schemata does not exist and the mnemonic method is rendered ineffective. Considering these methods as viable mnemonic techniques in the areas of science and social studies vocabulary is not plausible.

A mnemonic device that has received a spate of professional reviews

and has been the topic of numerous experiments with LD students is the keyword method. This method, described by some as phonetic encoding (Bellezza, 1981; Pressley & Levin, 1986), basically attempts to enhance the memory by facilitating the encoding process so that the retrieval of information is easier and more effective. By incorporating both auditory and visual cues with meaningful information, a strong association is formed enhancing both the semantic encoding and retrieval processes. The steps of this process are as follows (Levin, 1980): 1) the stimulus word is changed to a word that is acoustically similar or is easy to picture like a noun - that new word is then the keyword; 2) the keyword is then integrated with the definition or characteristic of the stimulus word in some interactive manner; 3) upon request, the stimulus word and meaning is retrieved as the subject makes the auditory and visual association. In Levin's explication of the theoretical tenets of this method he states that when the unfamiliar stimulus word is evoked with meaningfulness and thematic interaction, the encoding is more reliable, thus durable, over time. To support this hypothesis, Levin and a host of colleagues and other researchers have studied the keyword method in manifold contexts with LD students.

Research has shown that the keyword method improves LD students recall of vocabulary, recall of facts and enhances prose learning. Condus, Marshall and Miller (1986) imposing the keyword method as an instructional strategy to teach vocabulary to LD children reported significant recall

improvements with this method. Identifying students with high and low receptive vocabularies, four treatments were imposed: keyword-image, picture context, sentence-experience context, or control. The results indicated that the LD children using the keyword method outperformed all other students even those identified as having higher receptive vocabulary. Also significant was the retention rate for the keyword group over both a two week and an eight week delay period. Condus et al. concluded that the keyword method was superior to other methods in facilitating recall and suggested that this method could be implemented in an instructional setting typical of special education environments.

Other vocabulary acquisition experiments have been conducted by Mastropieri, Scruggs, Levin, Gaffney and McLoone (1985). In the first experiment, LD junior high students were presented vocabulary under a mnemonic picture condition or a direct instruction condition. Subjects in the mnemonic condition outperformed the direct instruction subjects by almost 50% which was statistically significant at the $p < .001$ level. In the second experiment, the authors hypothesized that the LD students would self-generate the mnemonic image given keyword instruction and that their performance would be significantly higher than the performance of the direct instruction group. Again, results indicated a significant difference in performance with the mnemonic condition statistically higher than the direct instruction condition.

In a related study, Mastropieri, Scruggs and Levin (1986) examined the

differences in recall under the mnemonic and direct instruction methods with LD high school students. The mnemonic instruction condition included the keyword-pegword technique in which mineral names were taught with the keyword method and mineral hardness was taught by associating rhyming pegwords with numbers i.e. 1 is bun, 2 is shoe. The mnemonic pictorial image or keyword was then interactively represented with the pegword. The direct instruction condition consisted of teacher directed presentation of mineral names and actual pictures, reviews of hardness levels, questioning and immediate corrective feedback. The performance by the mnemonic group on immediate recall was significantly superior to the direct instruction group with group mean recall differences of 30%.

A similar study examining the effectiveness of the keyword method with vocabulary acquisition and recall of facts was conducted with junior high LD students by Scruggs, Mastropieri, Levin and Gaffney (1985). In direct instruction, mnemonic instruction, a free study or a reduced list direct instruction condition, students were presented North American minerals with three associated attributes. The attributes in the mnemonic condition were incorporated into the keyword pictorial representation with the hardness level associated to a pegword, color coding for the mineral's color and an interactive depiction for the mineral's use. Recall performance of the three full-list conditions was significantly superior for the mnemonic condition with no recall advantage in the direct instruction condition when compared to the free study

condition. Other findings suggested that the reduced list group's performance was descriptively similar (although not statistically significant) to that of the full-list mnemonic group in respect to number of items recalled and instructional time.

Veit, Scruggs and Mastropieri (1986) extended the multiple fact research to include keyword instruction of dinosaur vocabulary, attributes and reasons for extinction with LD sixth, seventh, and eighth grade students. Investigating whether multiple mnemonic systems would inhibit or facilitate recall performance, mnemonic and direct instruction groups were taught three daily lessons on dinosaurs. On immediate and delayed recall tasks, the mnemonic group outperformed the direct instruction group with the latter group also evidencing significantly more intralist intrusions. The researchers reasoned that the lack of performance deterioration on the delayed recall tests suggest the efficacy and viability of keyword mnemonic instruction of multiple facts for LD students.

The keyword mnemonic technique has also been investigated in comparison to the visual-spatial display technique in teaching mineral attributes to junior high and elementary LD students. Scruggs, Mastropieri, Levin, McLoone, Gaffney, and Prater (1985) contended that the function of visual displays as an organizational technique was less effective than the transformational technique of the keyword/pegword mnemonics method. In the first experiment with junior high LD students, recall under the mnemonic condition was superior to both free study and visual-spatial conditions with the performance in the latter

conditions statistically equivalent. In the second experiment, dichotomous mineral attributes were taught to fifth and sixth grade LD students using the same instructional conditions as in the first experiment. Again, the keyword/pegword group outperformed the other groups with recall differences ranging from 22 to 27%.

Keyword instruction has also facilitated memory for expository prose. Investigating the independent level at which LD adolescents applied mnemonically learned information, Scruggs, Mastropieri, McLoone, Levin and Morrison (1987) provided mnemonic or nonmnemonic illustrations and instructions on North American minerals with subsequent science reading passages embedded with the mineral vocabulary and attributes. On a test of immediate recall, the the keyword group outperformed the control group by classifying the minerals by attributes at a 93% level of accuracy as compared to the control group's performance of 55%. On a test of delayed recall, the mnemonic group retained more information and made better inferences based on their greater recall. The authors concluded that the imposed mnemonic instruction benefited the LD students' recall performance and was applied independently to vocabulary when the vocabulary is embedded in expository prose.

In another study in which McCormick and Levin (1984) used fictitious biographies, seventh and eight grade students were instructed in using various keyword conditions which evidenced few qualitative recall differences. The keyword conditions included: 1) the Keyword-Integrated condition in which an

acoustically similar image was integrated with multiple biographic characteristics in a single picture; 2) the Keyword-Chained condition in which the keyword was progressively linked to the preceding image yet not inclusive of all of the links; 3) the Keyword-Paired condition in which separate yet unrelated pictures were paired with the keyword image; and 4) two control conditions. The results indicated that performance in the three keyword conditions was superior to the control conditions while differences between keyword conditions was not significant. Although the research was conducted with non-LD students, it has direct instructional implications when considering the facility of using the keyword mnemonic device with LD students. The foremost implication is that the keyword method is facile; it can be used effectively within a variety of methodological adaptations which is a critical feature in the instruction of LD children.

Description of Selected Solution

From the research, the viability of using the keyword mnemonic device to improve the recall performance of LD children in the areas of social studies and science was apparent. First, numerous studies had proven that the keyword method was superior to other mnemonic techniques and to traditional direct instructional approaches. Also, the keyword method could be used in a variety of contexts with multiple levels of factual recall. Third, although most of the studies cited were conducted with older LD subjects, the studies with elementary LD subjects claimed improved recall. Finally, the keyword method afforded

adaptability and facility which are paramount characteristics of an instructional program for LD children.

Report of Action Taken

The procedures for implementing the solution strategy included preparation of keyword materials and establishment of an instructional sequence. The materials included selected lists of key terms from each content area and grade level. For each word, a familiar, concrete and acoustically similar word was identified as the keyword. On single sheets of paper, the keyword was then illustrated interacting with the meaning or attribute of the vocabulary. Above each illustration was the identified term with the keyword in parenthesis beside it and on the opposite side the meaning or attribute description was printed.

The development of materials was a complex procedure and required a great deal of time and ingenuity. Although the social studies and science vocabulary at the lower grade levels usually involved a single concept or attribute, the vocabulary in grades five and six was often multi-conceptual and required more elaborate interactive illustrations to depict the meanings. For example, for the vocabulary concepts 'Nile River Floods' (see Figure 1) and 'Minoans' (see Figure 2), the recall of two or more attributes were required. Consequently, the development and design of the illustrations were more elaborate and complex. Additionally, it was often necessary to include two separate yet related concepts within one illustration (see Figure 3).

The instructional sequence consisted of an initial training session and a sequence of lesson presentations. The training session included the presentation

Nile River Floods
(Mr. Flood)

1. Flood waters were trapped for irrigation
2. Flood waters carried silt

Figure 1 Keyword Illustration for Vocabulary Concept
'Nile River Floods'

Minoans
(minnows)

1. lived in Crete
2. cities well built with castle in center
3. had a writing system many copied

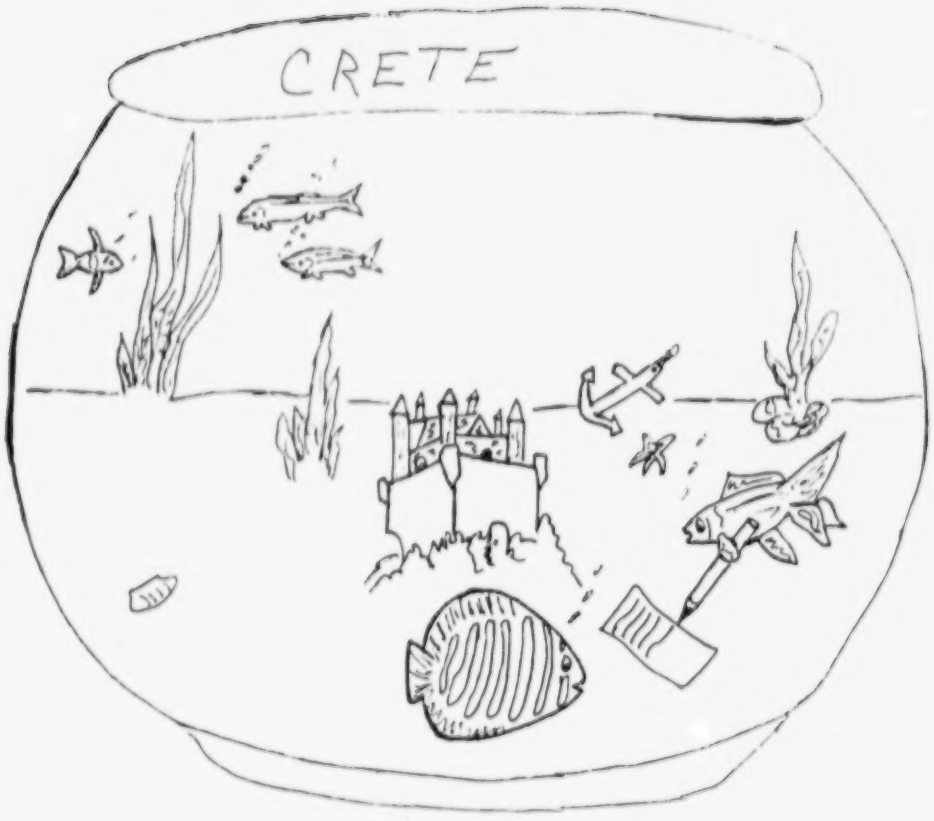

Figure 2 Keyword Illustration for Vocabulary Word 'Minoans'

Pacific Ocean (purple) - located on west coast of United States

Atlantic Ocean (ant) - located on east coast of United States

Figure 3 Keyword Illustration for Vocabulary Words 'Pacific Ocean' and 'Atlantic Ocean'

*Shaded purple

of five unfamiliar words in which the keyword format was used. A sample scripted lesson follows (Mastropieri, 1988):

We are going to learn some new vocabulary words and I'm going to teach you a special way of remembering these words. You can then use this special way of remembering to help you remember many of the science and social studies words you have in class. First, I'm going to teach you a keyword for each vocabulary word. A keyword is a small word that sounds like the vocabulary word and is easy to picture. For example, the keyword for 'carnivore' is 'car'. What is the keyword for 'carnivore'? Now I'm going to show you a picture that will help you remember the meaning of 'carnivore'. (Show illustration, Figure 4). The keyword for 'carnivore' is car. A 'carnivore' is a meat eating animal. What is the car eating? (answer) Remember this picture of the car eating meat. What is the keyword for carnivore? (answer) What does carnivore mean? (answer) (Remove illustration). When I ask you the meaning of the word you need to first think of the keyword. Then you need to think about what is going on in the picture. Let's practice what you've learned. If I ask you 'What does carnivore mean?', of what keyword do you think? (answer) What is the keyword doing? (answer) Correct, a carnivore is a meat eating animal. The remaining four words were presented in the same manner. Upon completion, the students were tested for immediate recall by presenting flashcards with the words only in which the student was asked the word and its meaning. If recall performance was 100%, the training was complete. If performance was not 100%, missed responses were analyzed as to problematic recall of the keyword or the interaction. The

carnivoire
(car)

a carnivore is a meat eating animal

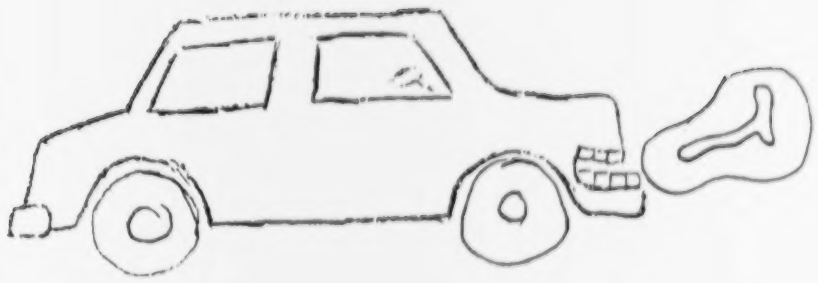

Figure 4 Keyword Illustration for Vocabulary Word 'Carnivore'

training lesson was then repeated when necessary.

The instructional sequence was repeated with a list of eight to ten words per week in each content area. At the beginning of each sequence, the previous lesson's words were reviewed and retaught if necessary. Immediate recall was monitored per lesson while delayed recall was tested using the classroom objective tests which are administered at the end of each text chapter; hence, testing occurred approximately every two weeks. A review of all chapter related words occurred one to two days before testing.

CHAPTER V

RESULTS, CONCLUSIONS, RECOMMENDATIONS

The goal of the mnemonic instructional program was that LD students would recall content related vocabulary through the application of the keyword mnemonic technique. It was expected that the LD students would perform at a 70% accuracy level on five of six science and social studies tests selected from the regular curricular programs.

Because the memory process is impossible to directly observe, it is necessary to assume that positive changes in test results are related to improved recall enhanced by specific mnemonic usage. Therefore, the following results, reported in terms of test means, suggest the students' utilization of the keyword mnemonic device as an aid in vocabulary recall.

Results

To measure the objective that the LD students would recall key vocabulary in science and social studies, six objective tests in each area were administered to 24 of the 25 participants. The one student who did not complete the battery of tests was absent excessively from both the instructional and testing components of the program and completed only two social studies tests. The performance criteria of 70% accuracy on five of six tests in each area was obtained by 24 of the 25 students with the one student not completing the number of tests necessary to meet the criteria or to make valid statistical judgments. Therefore, the test data for that student was not used in the various group analyses.

The general success of the mnemonic program was apparent when the test data were aggregated and statistically analyzed to provide results of the whole group's performance (see Table 4). It is evident from the range of test scores across the six tests in each subject area that each participant scored at or above the expected 70% accuracy level. It was also apparent that each participant exceeded the expected performance level of five tests of six since the range of performance was not below 70%. Also remarkable were the group performance means for both areas. Assuming that 80% or above is considered above average, the group's performance was clearly above average in both science and social studies. Equally notable were the improvement means. Compared to the test data of the original test administered prior to the implementation of the mnemonic program, improvement means of 49% in science and 40%in social studies indicated a substantial increase in performance.

Table 4

Group Test Performance Means in Science and Social Studies

Subject Area	Range of Performance	Performance Mean	Improvement Mean
Science	70-99%	87%	+49%
Social Studies	71-100%	89%	+40%

To examine intragroup performance distinctions, an analysis of the average test performance relative to several group variables was conducted. The variables included age/grade, IQ, memory related disabilities and reading

deficiency levels.

The test performance means for each grade level and associated age range is presented in Table 5. The greatest performance difference within an area was in social studies in which the grade mean at grade three was 87% while at grade four it was 92%; a variance of 5%. The greatest variance between subject areas was at grade two with a 4% higher performance mean in social studies than science. It appears that only slight performance differences existed between age/grade levels and subject areas. One possible interpretation of this finding is that the keyword mnemonic program is an effective method in aiding vocabulary recall at varying age/grade levels and subject areas.

Table 5

Grade Level Test Performance Means in Science and Social Studies

	Performance Mean in Science	Performance Mean in Social Studies
Grade 2 (Age Range: 7-8 yrs.)	86%	90%
Grade 3 (Age Range: 8-9 yrs.)	86%	87%
Grade 4 (Age Range: 9-10 yrs.)	89%	92%
Grade 5 (Age Range: 10-11 yrs.)	84%	86%
Grade 6 (Age Range: 11-12 yrs.)	88%	89%

To determine if intellectual ability had an impact on test performance, the participants were classified within three IQ ranges with the mean test performance for each subject area and IQ classification analyzed separately. The ranges were determined relative to the average score of 100 (on the WISC-R) and a standard deviation of $\pm$ 15. Since no student's full scale IQ scores was below 85, the first classification did not include a range. The results of the findings are summarized in Table 6.

Evidence of between subject area variance was minimal with no more than 2% difference between science and social studies in any IQ group. The differences of 8% in science and 9% in social studies between the highest and lowest IQ groups is notable and could suggest that students with higher IQs made greater use of the keyword mnemonic strategy. Yet, other interpretations are also plausible. For example, longer or more frequent instructional periods may be necessary for less able students to maximize their use of mnemonic strategies. Also, the 12 week instructional period may not be an adequate period for some students to maximally learn and apply the keyword method. Further investigations would offer a clearer understanding of the complex relationship between measured ability, recall test performance, and mnemonic strategy usage.

Next, each participant was classified into categories of memory related deficits with subsequent group means determined. The memory categories included students with a visual memory deficit, auditory memory deficit, auditory and visual memory deficits (A&VMD) and no apparent memory deficits (NMD). Preprogram implementation means and postimplementation

Table 6

Intellectual Ability and Differences in Test Performance Means

Number of Students	IQ Range	Performance Mean in Science	Performance Mean in Social Studies
8	85	84%	85%
10	86-100	88%	89%
6	101-116	92%	94%

means were then compared to obtain an improvement mean for each memory group and for each subject area. The results are presented in Table 7.

This comparative analysis led to many discoveries. First, as compared to the preimplementation means, all of the memory groups' test performance improved appreciably with the NMD group showing the greatest increase of 41% in science while the A&VMD group had the highest improvement mean in social studies with 57%. Also evident was the similarity in improvement means across the memory groups in science but distinct dissimilarity across several of the memory groups in social studies. The variance between the A&VMD and NMD groups was a notable 25%. Additionally, all of the memory groups except the NMD group made greater gains in social studies as compared to science with group differences ranging from 6 to 27%. The fact that the NMD group was an exception to this distinction can be attributed to its relatively high preimplementation performance in social studies of 61%. As a whole, the improvement means for all of the groups were substantial.

One of the most remarkable findings was that the A&VMD group's postimplementation performance was relatively similar to the other groups' performance in both subject areas. For example, A&VMD group's postimplementation mean of 84% in science was within 2 to 9% of the other groups' means. Considering that the A&VMD group experiences the most severe disability with memory deficits affecting two sensory modalities, their performance gains are perhaps more significant.

Table 7

Test Performance Comparisons Between Various Deficient Memory Groups

	Memory Groups			
	Visual memory deficits	Auditory memory deficit	Auditory & visual memory deficits	No apparent memory deficit
Postimplementation mean science performance	87%	86%	84%	93%
Preimplementation mean science performance	48%	46%	47%	52%
Mean improvement in science	+39%	+40%	+37%	+41%
Postimplementation mean social studies performance	89%	87%	88%	93%
Preimplementation mean social studies performance	33%	41%	31%	61%
Mean improvement in social studies	+56%	+46%	+57%	+32%

The final intragroup distinction examined was the possible relationship between reading level and test performance. The students were classified into three reading deficiency levels; 6 months below expectancy; 12 months below expectancy and 18 months below expectancy. No student was identified as reading at or above grade level. The test performance means for each subject were determined resulting in the information presented in Table 8.

A progressive increase in performance means between reading groups was evident with students reading only 6 months below expectancy level outperforming the lower reading groups in both subject areas. Although the highest and lowest reading group performance means varied by 10% in science and 13% in social studies, the 18 months below expectancy group's performance remains well within the performance criterion of 70%. These findings suggest two conclusions. First, students that are reading from 6 to 18 months below expectancy can perform at or above a 70% accuracy level on science and social studies tests. Implied in this conclusion is that test performance is related to vocabulary recall associated with mnemonic strategy usage. Second, reading is a dynamic combination of a number of reading correlates; only one of which is vocabulary recall. Variations in test performance can be the result of multiple interactive correlates or deficits.

In addition to the objective tests, two other measures were used to further assess the mnemonic program's success. The measures included a student strategy interview and a readministration of the regular teacher questionnaire. Descriptions of both instruments and the results follow.

Table 8

A Comparison of Reading Deficiency Groups' Test Performance Means

Reading Deficiency Level	Science Performance Mean	Social Studies Performance Mean
6 months below expectancy N=16	90%	92%
12 months below expectancy N=5	84%	86%
18 months below expectancy N=3	80%	79%

When the LD students' problem with vocabulary recall was studied before the keyword mnemonic program was designed or implemented, it was concluded with the use of an informal interview that most of the students were familiar with the utility or need for memorial strategies. To assess the LD students' metamemorial awareness following the keyword mnemonic program, a student strategy interview was developed and given to the 24 of the 25 participants who completed the program (see Appendix B). When questioned as to what they did to remember science and social studies vocabulary, 18 of the 24 students replied that they used the keyword method. Five of the six responding differently, answered with other reading related replies; such as 'I say the beginning sound' or 'I read the rest of the words in the sentence'. When these same students were then asked if they used the keyword steps, all responded affirmatively. The one student who did not respond with a reading related reply to question 1, responded instead 'I ask the teacher's aide'. When questioned further if she used the keyword steps, she simply replied 'no'.

The 23 students affirming their use of the keyword technique were also asked to relate the steps of the strategy. Responses were considered correct if they contained both of the following points in any order: 1) remember the keyword; and 2) remember the picture of what the keyword is doing. Reasonable facsimiles were accepted.

The results of the request to relate the keyword steps were that all of the students were able to identify the first step of remembering the keyword while only 16 of the 23 gave responses to the second step of remembering the

interactive illustration. Inappropriate answers included responses mentioning the picture but failing to mention the interaction involved which is the direct link to the recall of the meaning of each word.

Generally, this student strategy information suggests that 23 of the 24 participants associated the keyword mnemonic strategy with the recall of science and social studies vocabulary. Twenty three of the 24 LD students also attested to remembering the keyword. In comparison to the preimplementation conclusion that indicated a general strategy unfamiliarity, these findings suggest a considerable increase in metamemorial awareness.

As a final measure to assess the impact of the mnemonic intervention program as it relates to the regular teachers' perceptions of the LD students' learning behavior, the Teacher Questionnaire was readministered (see Appendix A). Twenty regular teachers responded to the questions regarding the 24 LD students with each questionnaire completed personally with the writer so that comments could be recorded. The questionnaire results as compared to the preimplementation results are summarized in Table 9.

Generally, the percent of students identified as having difficulty with general and specific concept comprehension and the recall of basic facts remained relatively the same with postimplementation decreases of between 1 to 4%. Conversely, substantial decreases in students identified as having difficulty recalling key vocabulary (item 4), supplying vocabulary to short answer items (item 5), and recognizing vocabulary in multiple choice items (item 6) were evident with postimplementation decreases of 38%, 28% and 23%,

respectively.

These latter results can be interpreted from two perspectives. In one regard, teachers identified less LD students as having vocabulary recall difficulties implying that for some the mnemonic intervention program was successful. From another perspective, when the results from the students' performance are considered, there is a notable difference in the teachers' perceptions of student vocabulary recall difficulty and their actual vocabulary achievement measured by the objective tests. Since 100% of the LD students participating in the program clearly achieved at or above 70% on each of the tests administered during the 12 week program implementation period it was expected that the percent of students identified as not having vocabulary recall difficulties would more closely reflect the success the LD students' experienced.

A possible reason that so many LD students were judged contrary to their performance profile is that teachers may rely on perceptions rather than hard data in judging a student's success or improvement rate. If a student has a history of poor performance or learning problems, the negative perceptions associated with these characteristics may be difficult to dispel. Another reason could be that other student behaviors, such as noncompletion of assignments or incorrigibleness, may be the primary behaviors considered in making student performance judgements.

As a final note regarding the teacher questionnaire, the teacher comments given were positive and encouraging. Several of the regular teachers remarked that the LD students were more enthusiastic about science and social studies, in

general. Others commented that students volunteered more frequently and appeared more confident.

Table 9

Regular Teachers' Pre and Postimplementation Responses to Social Studies/ Science Questionnaire

	Preimplementation Responses		Postimplementation Responses	
	Student has difficulty	Student does not have difficulty	Student has difficulty	Student does not have difficulty
1. General concept comprehension	16%	84%	15%	85%
2. Specific concept comprehension	24%	76%	20%	80%
3. Recall of basic facts	44%	56%	42%	58%
4. Recall of key vocabulary	92%	8%	54%	46%
5. Supplying vocabulary	96%	4%	68%	32%
6. Recognizing vocabulary	72%	28%	49%	51%

In conclusion, the keyword mnemonic program was considered successful in increasing 24 LD students' recall of social studies and science vocabulary as measured by objective tests. The results with respect to various intragroup characteristics suggested that the program was effective with some between and across group performance variance noted. In sum, each participant met or exceeded the program objective of 70% performance accuracy on five of six trials.

Conclusions

The goal of the practicum that LD students would recall content related vocabulary through the use of the keyword mnemonic technique was achieved within the expected criteria of 70% accuracy on five of six objective tests in the areas of science and social studies. The group results presented evidence of the practicum's overall success while the intragroup results provided a means of analyzing the success relative to specific group variables.

One of the most significant discoveries upon analyzing the group data was that all of the 24 of the 25 LD students completing the practicum mnemonic program exceeded the 70% criterion. Further the minimal performance standard of five of six trials exceeded with the 70% or greater accuracy criterion accomplished on every test. These remarkable findings suggest that the keyword mnemonic intervention program is an important method in mitigating the deleterious effects of vocabulary recall difficulties experienced by the elementary LD students.

The conclusion that the keyword mnemonic program is an integral factor in the LD students' improved vocabulary recall is supported by numerous research studies. For example, when Scruggs et al., (1985) compared the recall performance of LD junior high students using various instructional conditions, the mnemonically trained students performed significantly better. Similarly, Veit et al., (1986) found that the LD elementary and junior high students instructed in using the keyword method made significant gains in vocabulary recall as compared to students receiving semantic elaboration. One implication

of the superior keyword training results cited in the research studies and implied from the practicum results is that the keyword instructional method has an exceptional potential of improving the recall of vocabulary compared to other instructional methods.

The intragroup results led to more specific generalizations and conclusions about the effectivess of the keyword program. One set of results, analyzed according to grade/age levels, provided evidence that the LD students performed equivocally across and between grade/age levels in both subject areas. Although no research support of the effectiveness of the keyword program with students in grades two through five could be found, it can be concluded that these grade groups do benefit from the keyword instruction.

Results from the data analyzed by IQ groups suggested the conclusion that the LD students within the highest IQ range, 101-116, benefited most from the keyword program. Yet considering that each IQ group's test performance was well within the expected performance standard, conclusions related to IQ in general are perhaps more valid. It would appear that LD students with an IQ of between 85 and 116 utilize the keyword strategy effectively implying that IQ may not be a distinct factor in determining success. Research in support of this idea is indirect and sparse. Mastropieri et al., (1986) found that educably mentally retarded (EMR) junior high school students with IQs between 58 and 74 recalled a significant number of science words when given keyword instruction as compared to direct instruction. Although no conclusions can be drawn about the EMR students' performance with regard to other populations with higher IQs, it

is evident that students with lower IQs benefited from keyword instruction. Further studies are needed to clarify the relationships between IQ, mnemonic strategy usage, and recall performance.

When the results of the LD students' test performance means were grouped and analyzed within various memory categories, several conclusions about the potential of the keyword method to improve vocabulary were suggested. First, the keyword method effected considerable recall improvements regardless of the types of memory problems experienced by the students. Second, these improvements were noted in both science and social studies. Additionally, the multisensory design and composition of the materials delimited the effect that perceptual memory problems can have on the recall of vocabulary. These conclusions have important implications for the special educator. Because the keyword instructional method combines sensory approaches, it can be used as the sole perceptual instructional strategy rather than the multiple instructional strategies usually required to address varying memory problems of the LD population. Also, the same instructional sequence can be applied in both science and social studies.

Another set of intragroup results, those related to the relationship between reading deficiency levels and vocabulary recall, suggest as a whole that LD students with moderate to severe reading difficulties can recall content related vocabulary at their respective grade levels. This conclusion implies that the type of vocabulary instruction given, specifically the keyword method, had a considerable impact in ameliorating the LD students' recall of vocabulary in

science and social studies. Support for the contention that vocabulary performance is related to the method of instruction is provided in several studies comparing direct and keyword instruction (Mastropieri, et al., 1986; Mastropieri, et al., 1986; Scruggs et al., 1985). Conclusions from these studies indicated that LD students recalled significantly more vocabulary when the keyword instructional technique was used. However, these researchers caution against viewing the keyword and direct instructional methods as competitors. Rather, they contend that within the total reading and recall process, these instructional methods complement each other.

In general, the group and intragroup conclusions offer a variety of explanations regarding the effectivesness of the practicum program relative to observable and measurable student behaviors. In addition, conclusions about the LD students' metamemorial awareness can be drawn from the results of the student strategy interview. For example, the fact that a specific mnemonic strategy was mentioned by most of the students suggests their awareness that mnemonic strategies and vocabulary recall are related. This conclusion takes on greater significance when viewed within the context of the group and intragroup performance results that clearly suggested a relationship between the keyword intervention program and vocabulary recall improvements. This perspective in conjunction with the conclusion that most of the LD students are aware of the strategy's usage, suggests that the students are regularly and effectively applying the keyword mnemonic strategy.

The final set of results reflected the regular teachers' perceptions of the

LD students' science and social studies vocabulary difficulties. The unexpected and alarming results indicating that approximately half of the LD students were still identified as having vocabulary difficulties has important implications for the regular and special educators. Foremost, it is imperative that the regular teachers become aware of the nature of the keyword instructional program and the potential of this program to effect performance changes. Additionally, an effective means of recognizing and monitoring vocabulary performance as a distinct behavior should be developed and used as a basis of communication between the regular and special educators.

In conclusion, it is apparent that the keyword mnemonic program was instrumental in improving the LD participants' recall of science and social studies vocabulary. As a mnemonic strategy for students, the keyword technique proved effective across and between several intragroup variables and subject areas. As an instructional method, the keyword program was a versatile and viable means of vocabulary instruction. Consequently, the keyword mnemonic program will be continued in the writer's setting with inclusion of an inservice program for regular educators.

Recommendations

The first recommendations concern the instructional format of the keyword program. To determine the number of students instructed at one time and the length of the instructional programs, monitor the student responses and record the instructor's impressions during the initial training session. This can also provide an estimate of the number of words reasonably and effectively presented

in each lesson.

It is also recommended that other instructional methods such as direct instruction continue during the implementation of the keyword program. This recommendation stems from an experience the writer had at the midpoint of the practicum implementation. She was informed by some of the regular elementary teachers that due to various reasons, direct instruction in the areas of science and social studies had ceased. Realizing that the LD students would not have the general concept awareness necessary to make a vocabulary association, the writer provided the direct instruction in both content areas in addition to the keyword instruction. Therefore, it is recommended that regular and special educators use the keyword instruction as a supplement to the direct instruction usually given.

Extending the instructional program over a long implementation period is recommended. By increasing the keyword to one semester or an entire school term, additional factors related to recall could be determined; this includes factors such as long term vocabulary recall or skill transference.

The second set of recommendations concerns the development of the keyword materials. First, determining the keywords and creating the interactive illustrations is very time consuming. For those developing the program and materials for the first time, it may be preferable to work only in one subject area. Second, unless one is exceptionally talented in drawing, other means of depicting the illustrations are necessary. The writer suggests using a combination of free-hand drawings and black lined pictures clipped from primary

reading readiness workbooks. These pictures are readily adaptable and are easily photocopied or copied on transparencies. Third, when a word does not lend itself to either a keyword that is acoustically similar or an illustration that depicts an interaction, it is suggested that other mnemonic methods are tried such as color coding or elaborated pictorial representations.

Dissemination

Two activities have been planned to promote the application of the keyword mnemonic program: a city-wide inservice program for elementary LD teachers and an inservice program for regular educators at the writer's work site. Recently, the writer submitted an incentive grant proposal to a state special education organization requesting partial funding to train special educators in using the keyword program. The inservice proposal has been enthusiastically received by the writer's special education supervisor and has an endorsement and pledge for partial funding from the writer's school corporation. Also, if the program is funded by the state special education organization, a description and evaluation of the program will be presented at the annual state conference.

A series of workshops will also be conducted with the regular teachers at the writer's primary school site. These workshops will include a description of the results of this practicum, an overview of the keyword program, and a description of evaluation techniques.

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APPENDICES

APPENDIX A

TEACHER QUESTIONNAIRE

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In the areas of social studies and science, does (student's name) have problems in the following areas:

	Yes	No
General concept comprehension		
Specific concept comprehension		
Recall of basic facts		
Recall of vocabulary		
Supplying vocabulary to short answer items		
Recognizing vocabulary in multiple choice items		

APPENDIX B

STUDENT STRATEGY INTERVIEW

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STUDENT STRATEGY INTERVIEW

Questions are asked orally and recorded below.

1. What do you do to remember the meaning of social studies and science vocabulary? (If the response includes any mention of the keyword steps, go to item #3. If the 'keyword' is not given, ask question #2).

2. Do you use the keyword steps? (Stop here if answer is 'no'. Proceed with number 3 if answer is 'yes').

3. Tell me the two keyword steps to remembering vocabulary: (Appropriate answers must include the following salient points:)

    1. Remember (or think of) the keyword or the word that sounds like the vocabulary word.
    2. Remember (or think of) the picture of what the keyword is doing (the interaction).